

BOOK REVIEWS

The Universe in Time. Paolo Maffei. 1989. MIT Press, Cambridge, MA. 375 p. \$29.95 cloth.

Most astronomy books approach the topic of the universe in a spatial sense, beginning with the earth and moving out to the solar system, stars, galaxies, and the universe at large. This book is different; Maffei deals with the subject in a temporal sense by creating voyages through time to describe the origin and evolution of stars, planets, life, galaxies, and the universe.

This volume is a sequel to Maffei's *Beyond the Moon*, in which the universe is described in the spatial sense. Here, the universe is seen unfolding. The author's viewpoint is a teleological one; he sees the universe culminating in self-awareness with the emergence of sentient life, and humans a step along that path. In this way, we find more importance than when viewed from only a spatial perspective with its vast distances.

Maffei begins by recounting the well-known short time-cycles such as the day, month, and year; he describes the slow changes in them as a way to introducing the astronomical ages of the earth and universe. Then, the sequence of stellar evolution is described with good attention to both supporting observations and physical processes. Stars of different masses are traced through the protostar, main sequence (hydrogen-fusing), red giant, and various terminal phases such as white dwarfs, neutron stars, and black holes. Next follows a brief description of the accretion of planets and satellites.

The book's longest chapter describes "the transformations of the earth," a sweeping summary of the evolution of life, with attention to concomitant continental drift and plate tectonics, and evolution of the atmosphere, including astronomical climate cycles and increase in oxygen content.

Maffei next describes potential catastrophes to human life such as an asteroid impact, changes in solar activity, or self-destruction, but shows that other species, such as insects, could survive and become dominant.

In the following chapter, he concludes that life elsewhere is also likely, owing to the abundance of prebiotic molecules found in the interstellar medium and in meteorites, and to the probable frequency of planets around other stars.

The last third of the book turns to cosmology and the early epochs of the universe. First, the ages of the oldest star clusters in the Milky Way are examined and the evolution of our galaxy is outlined, with emphasis on the production, in earlier generations, of stars from the elements now comprising planets and life. This scenario is used to show that time is asymmetrical, not cyclical. The author then looks to the beginning of the universe with an explanation of the classical "Big Bang" model, including a fascinating visual description and enumeration of consequences such as the cosmic background radiation, atoms of hydrogen and helium, and later, the more obscure origin of galaxies. Next, the author compares open and closed models of the universe (corresponding to eternal expansion and eventual contraction, respectively) and describes speculative scenarios of the very far future for each case, including Dyson's theory that living

beings could survive on a finite amount of energy.

In the final chapter, Maffei describes interesting work showing that the universe is finely balanced for life; if the fundamental constants such as strengths of the basic forces and the rate of expansion were only slightly different, the conditions necessary for life (such as long-lived stars and heavy element production in stars) would not have arisen. He concludes the universe may be purposeful as stated above.

Obviously this conclusion will elicit a variety of reactions from readers. This reviewer is inclined to be sympathetic, but that is a purely personal reaction.

The author is an astronomer at the University of Perugia in Italy. The book was written in 1982 and translated into English in 1989. The translation is good and easy to read.

Since the translation came seven years after the original publication, the most recent research incorporated in the book is about a decade old, so some important work of the 1980s is necessarily missing, for example, the inflationary epoch (a period of very rapid and homogenizing expansion) early in the Big Bang, and new evidence supporting an asteroid impact as the cause of mass extinctions about 65 million years ago (whereas the author prefers the effects of a nearby supernova). The book does include evidence that dinosaurs were warm-blooded, and the histories it describes generally remain the currently accepted models.

The book is aimed at the general reader, but the level of detail varies, ranging from vivid descriptions that bring quantitative results to life, to sections that include more jargon than the general reader might prefer. The text is adequately illustrated with black-and-white photographs and line drawings. In the astronomical sections, the author frequently cites specific recent (circa 1980) literature, sometimes creating the misleading impression that most of the scientific advance has come from only a few selected papers. In general, however, his selection of topics is well-balanced and the exposition is clear and accurate.

Since the subject range is quite interdisciplinary, including astronomy, biology, and geology, most readers of this journal should find much of interest in this book, particularly in the areas outside their specialty. In a reasonably short space, the text describes the evolution of most of the physical systems of the Universe we see from earth; a set of scenarios that should be useful to many working scientists and science educators.

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Digital Signal Processing: Applications to Communications and Algebraic Coding Theories. Salvatore D. Morgera and Hari Krishna. 1989. Academic Press, San Diego, CA. 233 p. \$37.95 hardcover.

This book is written to explore one intersection of the three disciplines; the design of computationally efficient digital signal processing algorithms over finite fields, and the relation of these algorithms to algebraic coding theory, especially to error-correcting codes. The importance of this book as a text and research resource looms large and will get increased to those who are in the field of digital

signal processing and its wide applications, as the exploration on the integrated study of the above three disciplines is greatly needed than ever before.

As is well described by the authors in the preface, the problem of finding computationally efficient digital processing algorithms in a number-theoretic manner has been a relatively new area of research in the last 10 years. However, it can strengthen and re-establish the threads back to classical mathematics and open up numerous applications for applied mathematicians and arithmetic complexity theorists. As a person involved with teaching in those disciplines, especially in digital signal processing and coding theory, this book will be a valuable guide for the in-depth study in the field of digital signal processing and error-correcting code in advanced academic offering.

The 6 chapters of material in *Digital Signal Processing* are subdivided into three parts: "Overview and Perspective," "Algorithm Development Related with Finite Field Theory," and "Application to the Algebraic Coding Theory." Chapter 1 gives the introduction and a general overview of the book. It clearly states the approach of the authors to design efficient algorithms for the two basic signal processing techniques, periodic (cyclic) and aperiodic convolution within the framework of the bilinear form. Also, it gives the idea of employing these algorithms for designing linear-error correcting codes.

Chapter 2 is devoted to the brief review of the computational complexity, especially the multiplication complexity, associated with systems of bilinear form over an extension of a field of constant, and the description of interesting connection of system of bilinear forms to error-correcting codes. Chapter 3 presents the development of the computationally efficient algorithms, either for the cyclic or aperiodic convolution of discrete sequence over finite fields, which has received far less attention than any of the real and complex fields before. Based on the systematic design of bilinear algorithm for length N cyclic convolution over a field of constants, that is also compared with classical CRT (Chinese Remainder Theorem) in multiplication complexity, authors also investigate the applicability of the algorithm of cyclic convolution to aperiodic convolution by embedding or multidimensional methods.

Chapter 4 is devoted to the design and study of long length cyclic convolution in terms of mapping one dimensional sequence into multidimensional sequences by the use of mutually prime factors. Some preliminary results on their relation to linear codes in terms of distance property are presented. Also, this method is compared with CRT. Chapter 5 presents the results of study on the algebraic structure of the binary linear code obtained from the developed bilinear cyclic and aperiodic convolution algorithms over the finite field. Aspects of error correction as well as encoding/decoding procedures of this class of linear code is well explained in terms of various examples.

Finally, in Chapter 6 emphasis is given to the applications of the linear codes developed in the previous chapter and KM code for the various generalized hybrid ARQ (Automatic Repeat-Request) schemes for adaptive error control in digital communication system.

Even though some familiarity with abstract algebra, algebraic coding theory, as well as digital signal process-

ing is required, I found this book is fairly interesting and very helpful. Development of algorithms are clear and well organized. Abundant examples and appendices are a great help in understanding the mathematical explanations and algorithms developed through the book.

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Darwin Without Malthus: The Struggle for Existence in Russian Evolutionary Thought. Daniel P. Todes. 1989. Oxford University Press, New York, NY. 221 p. \$45.00 hardcover.

This volume is the seventh in the *Monographs on the History and Philosophy of Biology* series published by Oxford University Press. Todes explores the response of Russian naturalists of the latter 19th and early 20th centuries to Darwinism, and in particular their response to the Malthusian nature of the Darwinian metaphor, the "struggle for existence." As others have indicated (e.g., Mayr and Provine 1980), Malthusianism never gained great acceptance in Russia and as a result, Russian evolutionary biologists found Darwin's emphasis on intraspecific competition as a force in natural selection problematical. Todes argues that the widespread non-Malthusianism and anti-Malthusianism in Russia arose from "the basic conditions of Russia's national life." This included a political economy devoid of laissez faire capitalism and a harsh temperate climate characterized by vast expanses of sparsely-populated land. Whereas Darwin and Wallace drew on the benign, species-rich environments of the tropics for empirical support for the struggle for existence, Russian naturalists were exploring the harsh environs of Siberia where the struggle against the physical environment appeared pre-eminent over the effects of competition.

Certainly I would agree with Todes that the differences in empirical paradigms between Darwin and Russian naturalists contributed significantly to the disagreement between the two traditions. Russian evolutionists placed a greater emphasis on the Neo-Lamarckian view of the inheritance of acquired characteristics as a mechanism for adaptation against physical forces. Further, the theory of mutual aid, championed by Kropotkin, argued that cooperation among conspecifics against the physical environment, rather than intraspecific competition, was the rule in nature. Interestingly, these evolutionary views of Russian naturalists had their parallels among contemporary 19th century American evolutionists. The first American school of evolutionary biology, established largely by E. D. Cope and A. Hyatt, was founded on Lamarckian and Neo-Lamarckian principles. North America, like Russia, was also an expansive region with a temperate climate, and was still undergoing exploration in the latter 19th century. Unlike Russia, however, capitalism was firmly established in the United States, and philosophical opposition to Darwinism had its roots in religion rather than in socioeconomics (Moore 1979). Thus, one can quibble with Todes over how significant political tradition was of

itself a factor in the Russian rejection of the Darwinian metaphor. The similarities in 19th century Russian and American evolutionary thought are paralleled by similarities in the empirical paradigms on which the two groups worked. In fairness, Todes suggests (endnote 4 of the Conclusion) that such a U.S.-Russian comparison might prove interesting.

This slight difference of opinion aside, Todes has provided an excellent historical account of the 19th century evolutionary tradition among Russian naturalists. This book should be of interest to evolutionary biologists in general, and will be invaluable to scholars in the history and philosophy of evolutionary biology. The writing style is clear and the book is well edited to include photographs of some of the key Russian naturalists and of 19th century Russian life. I was disappointed, however, that the book lacked a bibliography and that references had to be gleaned from the endnotes.

LITERATURE CITED

- Mayr, E. and W. B. Provine, eds. 1980. *The evolutionary synthesis*. Harvard University Press, Cambridge, MA. 485 p.
 Moore, J. R. 1979. *The post-Darwinian controversies*. Cambridge University Press, New York. 514 p.

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The Pinnipeds: Seals, Sea Lions, and Walruses. Marianne Riedman. 1990. University of California Press, Berkeley, Los Angeles, Oxford. 439 p. \$28.50 hardcover.

Humans, increasingly aware of a quality dimension to life, are beginning to appreciate the need to invest in environment and nonhuman life. Our ethics gradually are modulating from taming and exploiting nature to conserving and managing resources for biodiversity, and sustainable yields. Given our terrestrial bias, most concern to the present has focused on ecosystems such as the tropical rain forest and on land biota. Our positive involvement with the marine system, with the exception of whales and to some extent marine turtles, has been slower to develop. This has been, in part, because of the ocean's vastness and comparative remoteness, but also because we know even less about this vast realm that covers over 70% of our planet. Dr. Marianne Riedman's book, *The Pinnipeds*, is an important addition to both marine and terrestrial sides of the ledger, for her subjects are the amphibious mammals whose territory is the land-sea interface.

A wealth of information is brought together in this book about seals, sea lions, and walruses, so that most major aspects of their biology—systematics, physiology, ecology, evolution—are addressed. Additionally, a sampling of folklore literature and observations of natural history, a seven-page glossary, 56-page bibliography with references to 1988, and 27-page index are provided. The extensive and generally well-chosen figures, including 15 color plates, effectively illustrate the different species, their habitats, and key points of the text.

Chapter 2 provides vital systematic information for the 19 species of seals plus one extinct taxon (superfamily Phocoidea), and five walrus (superfamily Otarioidea). It also includes estimates of current population size, distinctions among the three major groups, and distributions. Since frequent comparisons are made here and elsewhere with other marine mammals, it would have been useful to extend the classification to show relationships with whales, manatees, and dugongs, and perhaps to include some illustration of geological time. The readily accessible classification schemes provided by the book's endplates facilitate reading for those not familiar with pinniped taxonomy.

Topics of other chapters are: adaptations for a marine existence; ecology; predation on pinnipeds; diet and food resources; mating systems, breeding behavior, and social organization; reproduction and life history; maternal care and lactation strategies; and communication, cognition, and learning. Bringing together a considerable amount of research literature is an obvious and important function of this book; another equally important contribution, especially for future workers in the field, is heightening the awareness of the many gaps in our knowledge of these fin-footed animals. The weakness of the existing data base is especially evident in the chapter called "Ecology" (which is, in light of the topics of subsequent chapters, a poorly chosen heading). In a scant 10 pages, Riedman poses and provides some information pertaining to a major biological question: the role of pinnipeds in the ecosystem and their impact on fisheries. Many readers cannot help but be aware of the difficulties of the field work inherent in contributing to an answer, and it is obvious that much work remains to be done. Unfortunately, however, the presentation of data in this chapter is more a catalogue of facts than reasoned discussion of their implications. The result is that important topics that should not be neglected even though data are limited—such as definition of biological niches, conservation, and management—are effectively side-stepped.

There are some smaller problems with the book. The overly frequent conversion of meters to feet and definition of relatively routine terms within the text will annoy rather than help many readers, and detract from the pleasure of their reading. Those aware of gender issues will be further distracted by a less sensitive use of language than should now be routine with authors and publishers. And those interested in geographical distribution of pinnipeds will find that many of the maps take longer to decipher than should be necessary.

The book, however, is an interesting, at times fascinating tome about a group of animals which we have tended to overlook. Pinnipeds merit much more study so that we may better understand not only their adaptations to life at the land-ocean interface, but their place in the ecosystems of which they are a part. Riedman's contribution of bringing together much information about pinnipeds is important and timely.

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Flowering Plants: Nightshades to Mistletoe. Robert H. Mohlenbrock. 1990. Southern Illinois University Press, Carbondale, IL. 240 p. \$40.00 hardcover.

Botanists like Dr. Mohlenbrock were studying biological diversity before it became a catch phrase—or even had that name—and before its significance was widely understood and appreciated. It is a pleasure to see another volume in Mohlenbrock's continuing study of the angiosperm diversity of Illinois. Thus far, he has published five small books covering all the monocots and six covering dicots, with about ten more required to complete the latter group. These are part of a larger, grand project that (quoting from an earlier volume in the series) will present "every group of plants, from algae and fungi through flowering plants," in a form useful "to the average person wanting to know about the plants of this state."

In the series, the flowering plants are arranged in Robert F. Thorne's system, slightly modified in this volume to include one Cronquistian element, the recognition of the Cuscutaceae as a family distinct from the Convolvulaceae. The present volume deals with the 98 Illinois species and two interspecific hybrids in three of Thorne's orders. The group includes eight families: the Solanaceae, Convolvulaceae, Cuscutaceae, Polemoniaceae, Campanulaceae, Celastraceae, Santalaceae, and Viscaceae. As noted in the foreword, the individual volumes of the series are published in no particular sequence. Unfortunately, with only this volume in hand, there is no way of knowing which dicot families have already been treated and which remain to be done, nor to what volume one may turn to see the coverage of a particular family that has been completed.

The botanical material is presented in an attractive, consistent, user-friendly style that includes for each species a brief technical description and statements of habitat, range, and flowering time, accompanied by a county dot-distribution map. These and the full set of generally excellent illustrations for each species should make possible the ready identification of most unknowns.

The drawings were done by the author's son Mark, the maps prepared by his daughter Wendy, and the manuscript drafts typed by his wife Beverly. Rounding out the family is son Trent, who accompanied his father on many field trips, and to whom the book is dedicated.

An unusual feature of this series is the attention given the flora's adventives. They are accorded the same full treatment as the native plants and the naturalized aliens. Here, for example, *Solanum sarrachoides*, *Nicotiana longiflora*, and *Jacquemontia tamnifolia*, although aliens known in Illinois from only a single collection site each, are covered as thoroughly as is a widespread species such as *Lobelia cardinalis*. Because the same adventives may appear again and puzzle some future naturalist, I find this a commendable practice. For those of us in other parts of the Midwest, these volumes provide a place where we can turn to find illustrations of some of our own rare adventives.

The format for the series being an expansive one, there are references to pertinent literature, but I wish there were more. Although it is presumably Davidson's revision of *Polemonium* (Univ. Calif. Publ. Bot. 23: 209-282. 1950.) that is being followed in the placement of *E. Lucy Braun's* var. *villosum* in synonymy under the species *Polemonium*

reptans, there is no citation of Davidson's work nor of Braun's cogent rejoinder (Rhodora. 58: 103-116. 1956.). The merger here is at best somewhat gratuitous since Braun's study showed the variety to be limited to a small area of south-central Ohio and immediately adjacent Kentucky. It would have been helpful to cite Levy's study on variation in *Phlox pilosa* (Syst. Bot. 8: 118-126. 1983.) and Ebinger's comments on the spread of *Euonymus alata* in Illinois (Natural Areas J. 3: 3-6. 1983.). Under the discussion of *Cuscuta campestris*, it would have been appropriate to note that Gleason and Cronquist (*Manual of Vascular Plants*. Van Nostrand Co. 1963.), and some current workers, merge this species under *Cuscuta pentagona*.

On the other hand, the book has a great deal of the kind of interesting local and regional information that cannot be found in floras of larger areas. Having recently been taken to task on the point, I noted with wry satisfaction that Illinoisans, like Ohioans, evidently use the name "Sweet William" for *Phlox paniculata*, although in most publications that common name is assigned exclusively to *Dianthus barbatus*.

This book is a fine addition to the many excellent studies of the biological diversity of Illinois.

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The Cambridge Illustrated Dictionary of Natural History. R.J. Lincoln and G.A. Boxshall. 1987. Cambridge University Press, New York, NY. \$14.95 paper.

The authors have been successful in providing an effective dictionary of natural history with extensive coverage of classification and a broad selection of ecological terms. Essential components of modern natural history such as feeding, behavior, population biology, reproduction, soils, habitats, ecological energetics, and life histories are all competently and adequately covered. No apparent major gaps were evident to this reviewer. The illustrations were limited but adequate.

Overall, the accuracy of descriptions or definitions appeared good. Realizing the difficulty in writing a dictionary to encompass the many divergent fields encountered in the realm of "natural history," the authors did a commendable job in providing accurate descriptions. However, in randomly selecting definitions, it is the opinion of this reviewer that at least a few of the definitions could be improved upon. For example, in defining the term VIRUS, this reviewer would not define viruses as a group of microorganisms traditionally regarded as a kingdom of prokaryote. In defining the term ALLOMONE, the reviewer felt that the term was inadequately described and no differentiation was made with the term Kairomone, which was not even defined.

In conclusion, the text is a good working dictionary of natural history. For the individual working or interested in natural history, the book should prove to be a valuable addition to one's library.

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